

# Mapping the Ledge

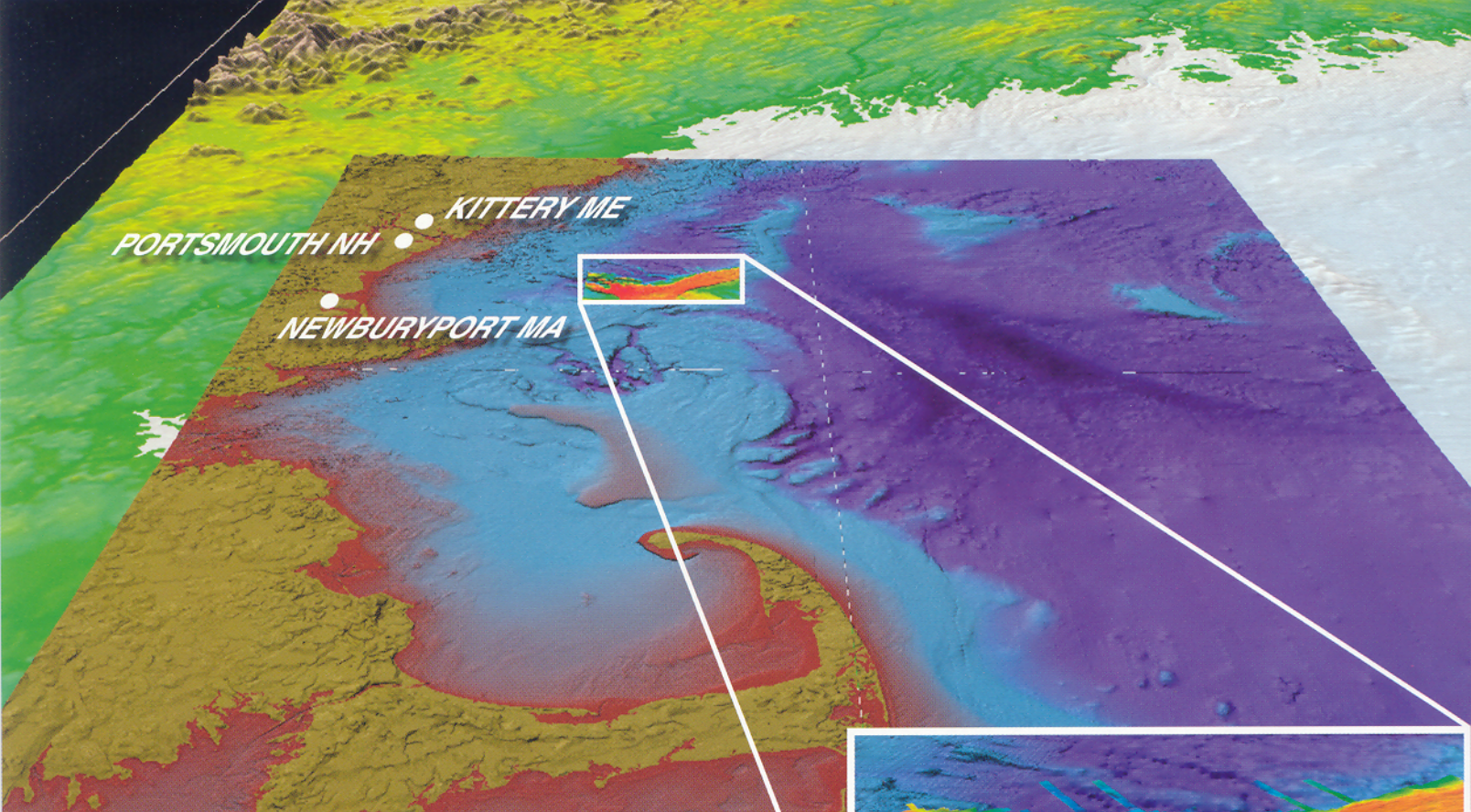
*Scientists and fishermen collaborate to understand the ecological effects of an ocean fishery closure on Jeffreys Ledge*

BY PETER H. TAYLOR

On April day in 2003, a boat carrying commercial fishermen and marine scientists cruised the ocean off New Hampshire's coast in search of schools of spawning cod. Rather than catching the fish, however, the team used underwater video and a fathometer to document the schools' sizes and locations, as part of a new, comprehensive study of the Western Gulf of Maine Closure Area. Fishing for cod, haddock, flatfish and other groundfish has been excluded in this area since 1997. What they found that day was impressive.

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A 3-D bathymetry image of the Atlantic coast, from Cape Cod north, shows the relative depths of the ocean's waters. The research team's study area covers 150 square miles and encompasses portions of Jeffrey's Ledge, seen in the inset as the red-orange strip running parallel to the shoreline.

BATHYMETRIC DATA FROM NOAA, USGS AND THE CENTER FOR COASTAL AND OCEAN MAPPING/JOINT HYDROGRAPHIC CENTER, UNH

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**"The Jeffreys Ledge area is a significant ecological feature in the Gulf of Maine, and the closure plays an important part in the fishery recovery plan by reducing mortality of cod and other fish."**  
— Andrew Rosenberg

"We located some pretty darn big schools," said marine ecologist Ray Grizzle of the University of New Hampshire. "We slowly motored across one school of cod for about a quarter of a mile, recording fish the entire time."

### Rebounding from the Cod Crash

Historically, the waters off New Hampshire and Massachusetts have been renowned for supporting a rich fishery, attracting trawlers, gillnetters and hook fishermen. However, cod stock in the Gulf of Maine crashed from some 100,000 tons in the 1960s to less than 20,000 tons in the 1990s, and other groundfish stocks suffered similar collapses. Fortunately, some rebound has occurred during the last five years, thanks in part to the Western Gulf of Maine Closure Area. This protected area measures 20 by 70 miles and includes

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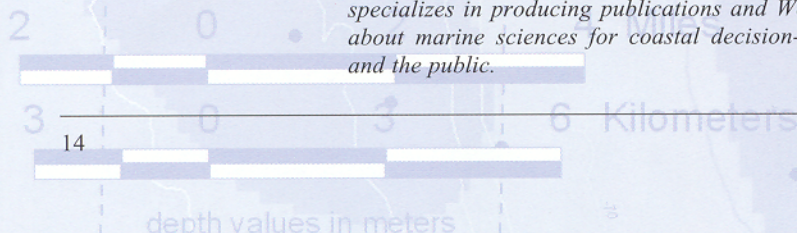
portions of Jeffreys Ledge — a relatively shallow glacial deposit that provides productive habitat for all manner of sealife. The large school of spawning cod gives hope for the future.

"The Jeffreys Ledge area is a significant ecological feature in the Gulf of Maine, and the closure plays an important part in the fishery recovery plan by reducing mortality of cod and other fish," said Andrew Rosenberg, a leader of the new study and dean of the UNH College of Life Sciences and Agriculture.

While marine protected areas, or MPAs, increasingly are being established around the world, few have been evaluated for their effects not only on fish, but on other aspects of the ecosystem. Unlike catch quotas and other measures, some MPAs protect the habitat from such impacts as damage caused by trawling gear. As a result, biodiversity is protected, not just a single species.

"This study is meant to understand the effect on the ecosystem — more broadly — of closing an area to fishing," said Rosenberg.

The Jeffreys Ledge study, initiated by Rosenberg, Grizzle and several UNH colleagues in September 2002, is designed to shed new light onto the workings of the ocean world, effects of the fishery closure on the ecosystem and effective





strategies for ocean management. Conducted in collaboration with commercial fishermen, the study will characterize the ecosystem within and next to the Western Gulf of Maine Closure Area by collecting information on plant production, sea surface temperature, seafloor habitats and predator-prey interactions. It will also produce valuable high-resolution maps of the seabed. The project will begin to examine how groundfish use different habitats and to evaluate the effects of the closure on ecosystem characteristics. The findings will help improve understanding and management of the marine environment in the Gulf of Maine and beyond — for recreationally and commercially important species like cod and haddock, but for myriad other marine species as well.

## Documenting Denizens of the Deep

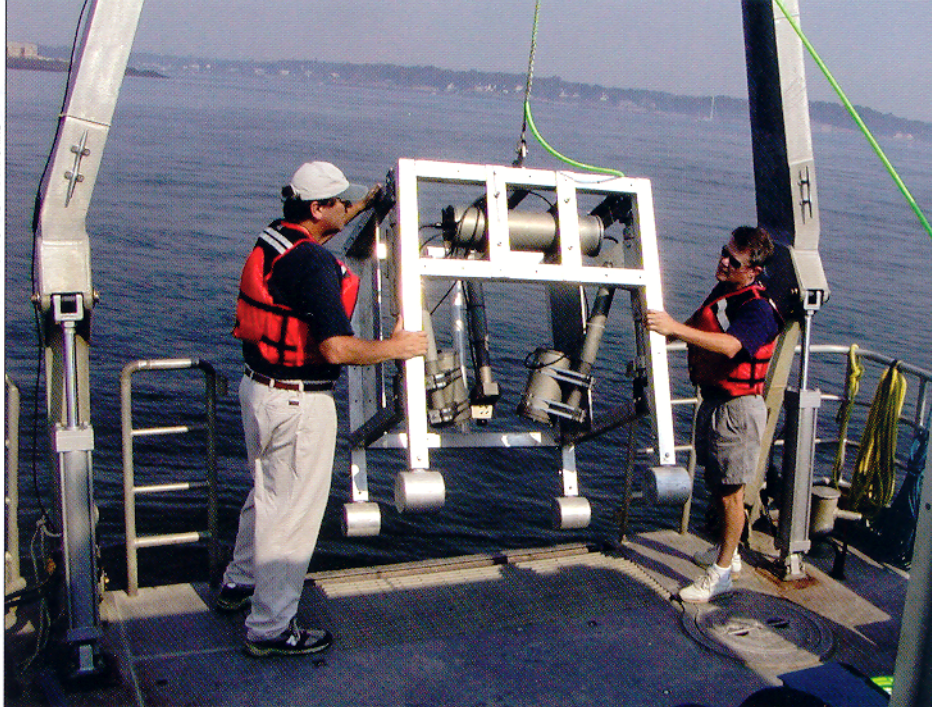
Last fall, the study got underway with mapping of the seabed using multibeam sonar, which produces images resembling aerial photographs to show contours, textures and geological materials of the seafloor. Larry Mayer, director of the Center for Coastal and Ocean Mapping at UNH, is leading the multibeam mapping effort. The goal is to map the entire 150-square-mile study area, which straddles the western boundary of the closed area, to allow comparisons of habitats inside and outside. These detailed maps will serve as a base for other components of the study and help the scientists determine the types and distributions of habitats.



For example, fields of boulders and small rocks characterize some habitats, while other areas are muddy or sandy. The ocean quahog, a commercially valued shellfish that grows up to five inches long, often populates soft-sediment habitats. Another dominant creature is a large, burrowing anemone that measures as much as a foot and a half long. It appears in the researchers' underwater video and photographs waving its feathery tentacles. Fellow denizens of the Jeffreys Ledge seafloor include sea stars, polychaete worms, crabs, scallops and lobsters.

"Based on the multibeam sonar images, we can identify features like rock, mud or sand waves," said Grizzle. "Then we use our underwater cameras and bottom sampling gear to confirm

PHOTO © UNIVERSITY OF NEW HAMPSHIRE



*Researchers Larry Ward (left) and Ray Grizzle deploy the Hubbard underwater video camera system, which takes images of the seabed.*

that what we think is mud actually is mud and so forth. Then we'll identify the creatures, and we'll be able to map the habitat types and dominant species across the study area."



*Ocean-floor images capture the habitats of various seabed dwellers, such as this anemone in the muddy sand, and starfish (below, left) clinging to algae-covered rocks.*

PHOTOS © U.S. GEOLOGICAL SURVEY

The scientists are looking for differences between habitats inside and outside the closed area, impacts of fishing gear on the seafloor, and evidence of how long it takes for biodiversity to recover. For example, boulders and small rocks in the fished area might have been overturned by trawling gear, knocking off animals that lived attached to the rocks. Meanwhile, rocks in the

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## Want to learn more? Dive in...

- Download a booklet and companion video called *The Science of Marine Reserves* at [www.piscoweb.org/outreach/pubs/reserves](http://www.piscoweb.org/outreach/pubs/reserves).
- Progress report on the Jeffreys Ledge study available at [cinemar.unh.edu/2002\\_report](http://cinemar.unh.edu/2002_report).
- The Gulf of Maine Council on the Marine Environment ([www.gulfofmaine.org](http://www.gulfofmaine.org)) provides a directory of information about seafloor mapping.
- The Gulf of Maine Mapping Initiative (<http://sh.nefsc.noaa.gov/gommi>) is a new transboundary program to map the entire gulf's seafloor.



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haven of the protected area might be overgrown again by large animals. Comparisons could also reveal the resilience of some habitats, such as sandy seabeds that naturally shift due to currents and storms. These areas might be less affected by fishing gear. The scientists are just beginning to gather data to explore these possibilities, which could affect the management strategy for each habitat.

## Ripples Through the Ecosystem

Another important component of the research program is to study how habitats, biodiversity and ecosystem productivity will change if fishing pressure is removed. For example, experiments will reveal differences in predation by groundfish, which prey on many creatures of the seafloor. In the closed area, groundfish are expected to be more numerous and bigger, and consequently might alter the prey populations, sending ripple effects throughout the ecological community.

Ultimately, the results of this comprehensive study could indicate whether it is useful to set aside portions of the sea from fishing to aid the ecosystem. Around the country, there has been a call for ecosystem-based management, and marine protected areas potentially offer a broad suite of benefits. "I think this study will be quite important as we move toward ecosystem-based management," said Rosenberg. "Understanding how closed areas like this may impact other components of the ecosystem could be vital in that debate."

In addition, findings from Jeffreys Ledge could influence the design of marine protected areas by showing which habitats are important to protect for particular purposes and how to build a coherent system of closed areas to achieve multiple management goals. Rather than establishing separate closed areas for cod, right whales and harbor porpoises, for example, managers might be able to establish protected sites to accommodate all.

## A Fitting Partnership

The scientists in the Jeffreys Ledge research program collaborate closely with commercial fishermen, working aboard their boats and sharing information. To help plan the study, the fishermen contribute a tremendous base of knowledge about the ocean and local species, such as places frequented by spawning cod. On a practical level, they are extremely good at deploying scientific sampling gear at sea.



*Research results will shed light on habitats and populations of groundfish — like cod, haddock and the well-camouflaged flounder (above).*

PHOTO ©U.S. GEOLOGICAL SURVEY

**"I think any knowledge of the environment can only help... the more we study it, the better answers we'll have."  
— Pete Kendall**




PHOTO BY JERRY AND NANCY MONKMANECOPHOTOGRAPHY.COM

*Commercial fishermen provide intimate knowledge of New Hampshire's marine fisheries to assist the researchers in their work.*

"You start spending a few weeks with these guys, and you start learning about things that there's no other source of information for," said Grizzle.

It's a fitting partnership, because the closed area represents an economic impact on the fishing industry and a huge national investment in the ecosystem. As the Jeffreys Ledge study progresses during the coming years, commercial fishermen, resource managers, recreational anglers and the public will gain a better understanding of how the investment is paying off — and how to maximize ocean protections in the future.

"I think any knowledge of the environment can only help," said Pete Kendall, a twenty-year veteran of the commercial fishing industry who is participating in the study. "Whether we'll be allowed access to fish that area again, I don't know. And whether we should be, I don't know. But the more we study it, the better answers we'll have." 



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